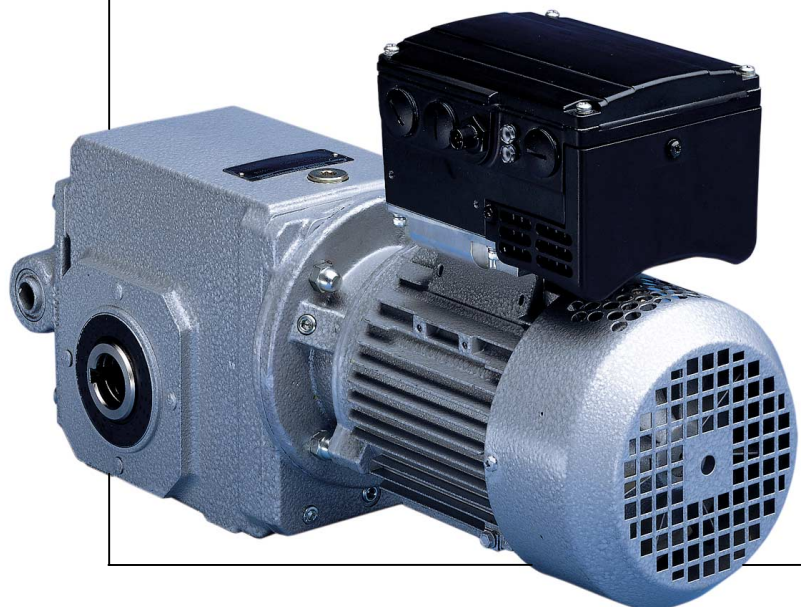# STÖBER CombiDrive®

SIEMENS Micromaster integrated

Installation and Commissiong instructions

It ist essential to read and comply with these instructions prior to installation and commissioning!

MANAGEMENTSYSTEM

certified by DQS according to
ISO 9001, ISO 14001
Reg-No. 25780

01/2001

GB

Contents

Safety Precautions

Before installing and putting this equipment into operation, please read these safety precautions and warnings carefully and all the warning signs attached to the equipment. Make sure that the warning signs are kept in a legible condition and replace missing or damaged signs.

⚠ WARNING

This equipment contains hazardous voltages and controls hazardous rotating mechanical parts. Loss of life, severe personal injury or property damage can result if the instructions contained in this manual are not followed.

Only suitable qualified personnel should work on this equipment, and only after becoming familiar with all safety notices, installation, operation and maintenance procedures contained in this manual. The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.

- The CombiDrive® operates at high voltages.

- ALWAYS isolate the equipment from the power supply before starting any work on it.

- The dc-link capacitor remains charged to dangerous voltages even when the power is removed. For this reason it is not permissible to open the equipment until one minute after the power has been turned off. When handling the open equipment it should be noted that live parts are exposed. Do not touch these live parts.

- The equipment must not be connected to a supply via an ELCB (Earth Leakage Circuit Breaker - see DIN VDE 0160, section 6.5).

- The following terminals can carry dangerous voltages even if the inverter is inoperative:

  -the power supply terminals L1, L2, L3.
  - the motor terminals U, V, W.

- Ensure that the inverter's cover has been fitted correctly before applying mains power to the CombiDrive®. If a Braking Unit has been supplied, ensure that the terminal connections fitted to the underside of the cover mate correctly with those on the inverter when refitting the cover.

- Only qualified personnel may connect, start the system up and repair faults. These personnel must be thoroughly acquainted with all the warnings and operating procedures contained in this manual.

- Certain parameter settings may cause the motor to restart automatically after an input power failure.

- This equipment must not be used as an 'emergency stop' mechanism *(see EN 60204, 9.2.5.4)*.

⚠ CAUTION

- Children and the general public must be prevented from accessing or approaching the equipment!

- This equipment may only be used for the purpose specified by the manufacturer. Unauthorised modifications and the use of spare parts and accessories that are not sold or recommended by the manufacturer of the equipment can cause fires, electric shocks and injuries.

- Keep these operating instructions within easy reach and give them to all users!

C€

European Low Voltage & EMC Directives

The CombiDrive® product complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

The units are certified for compliance with the following standards:

EN 60204-1	Safety of machinery - Electrical equipment of machines
EN 60146-1-1	Semiconductor converters - General requirements and line commutated converters
BS EN50081-2: 1995	Generic Emission Standard - Industrial Environment
BS EN50082-2: 1995	Generic Immunity Standard - Industrial Environment

Proviso: The CombiDrive® does not meet CE requirements when an OPm2 is connected.

European Machinery Directive

The CombiDrive® product (combined inverter and motor assembly) is suitable for incorporation into machinery.

The CombiDrive® must not be put into service until the machinery into which it is incorporated has been certified to be in compliance with the provisions of the European Directive 89/392/EEC.

Note: Only valid for machinery to be operated in the European Community.

European EMC Directive

When installed according to the recommendations described in this manual, the CombiDrive® fulfills all requirements of the EMC directive as defined by the EMC Product Standard for Power Drive Systems EN61800-3.

1. OVERVIEW

The CombiDrive® is an integrated motor/inverter for variable speed applications.

The inverter is microprocessor-controlled and uses state of the art IGBT technology for reliability and flexibility. A special pulse-width modulation method with ultrasonic pulse frequency permits extremely quiet motor operation. Inverter and motor protection is provided by comprehensive protective functions.

Features:

- Easy to install and commission.

- Closed loop control using a Proportional, Integral (PI) control loop function.

- High starting torque with programmable starting boost.

- Remote control capability via RS485 serial link using the USS protocol.

- Ability to control up to 31 CombiDrive® via the USS protocol.

- Optional remote control capability via RS485 serial link using PROFIBUS-DP.

- Factory default parameter settings pre-programmed for European and North American requirements.

- Output frequency (and hence motor speed) can be controlled by one of four methods:

   (1) Built-in potentiometer.

   (2) High resolution analogue setpoint (voltage or current input).

   (3) Fixed frequencies via binary inputs.

   (4) Serial interface.

- Built-in dc injection braking.

- Acceleration/deceleration times with programmable smoothing.

- Single signal relay output incorporated.

- External connection for optional Clear Text Display (OPm2) or for use as external RS485 interface.

- Fast Current Limit (FCL) for reliable trip-free operation.

- Optional factory-fitted resistive braking unit (also available as a separate post-sale option).

- Optional motor brake and interface.

- Integral class A or class B filter options.

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2. INSTALLATION

⚠	# WARNING
	To guarantee the safe operation of the equipment it must be installed and commissioned by qualified personnel only.
	Take particular note of the general and regional installation and safety regulations regarding work on high voltage installations (e.g. VDE), as well as the relevant regulations regarding the correct use of tools and personal protective gear.
	Use the lifting eyes provided if the motor has to be lifted. Do not lift machine sets (e.g. built-on gearboxes, fan units) by suspending the individual machines!
	If the PROFIBUS option has been fitted, remove the PROFIBUS module before attaching cables or chains to the lifting eyes.
	Always check the capacity of the hoist before lifting any equipment.

2.1 Wiring Guidelines to Minimise the Effects of EMI

The CombiDrive® are designed to operate in an industrial environment where a high level of Electro Magnetic Interference (EMI) can be expected. Usually, good installation practices will ensure safe and trouble free operation. However, if problems are encountered, the following guidelines may prove useful. In particular, grounding of the system 0V at the inverter, as described below, may prove effective.

(1)   Ensure that all equipment is well earthed using short, thick earthing cable connected to a common star point or busbar. It is particularly important that any control equipment that is connected to the inverter (such as a PLC) is connected to the same earth or star point as the inverter via a short, thick link. Flat conductors (e.g. metal brackets) are preferred as they have lower impedance at high frequencies.

 (2)   Wherever possible, use screened leads for connections to the control circuitry. Terminate the ends of the cable neatly, ensuring that long strands of unscreened wire are not left visible.

(3)   Separate the control cables from the power connections as much as possible, using separate trunking, etc. If control and power cables cross, arrange the cables so that they cross at 90°.

(4)   Ensure that contactors in the cubicle are suppressed, either with R-C suppressors for AC contactors or 'flywheel' diodes for DC contactors, **fitted to the coils**. Varistor suppressors are also effective. This is particularly important if the contactors are controlled from the relay connection on the CombiDrive®.

(5)   Use screened or armoured cables for the power connections and ground the screen at both ends via the cable glands.

**On no account must safety regulations be compromised when installing the
CombiDrive®!**

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2.2 Mechanical Installation

Figures 1 and 2 show dimensional information for all CombiDrive® variants.

Note: 'Case size' refers to the type of inverter box mounted on the motor. 'Motor frame' refers to the motor frame size only.

Remove or tighten down screw-in lifting eyes prior to using the CombiDrive®.

Stable foundations or mounting conditions, exact alignment of the motors and a well-balanced transmission element are essential for quiet, vibration-free running. If necessary, insert shims under the motor's feet to prevent strain, or balance the whole rotor and transmission element.

Always use the correct tools for fitting and removing transmission elements (coupling halves, pulleys, pinions, etc.).

The rotors are dynamically balanced with the full featherkey inserted as standard. Since 1991 the type of balance has been marked on the drive end of the shaft (shaft end face). **F** denotes balanced with **full** featherkey; **H** denotes balanced with **half** featherkey. Bear in mind the type of balance used when fitting the transmission element.

Poor running characteristics can arise in cases where the transmission elements have a length ratio of hub length to length of shaft end < 0.8 and they run at speeds of > 1500 rpm. In such cases rebalancing may be necessary, e.g. by reducing the distance by which the featherkey protrudes from the transmission element and the shaft surface.

<table>
<tr><td>⚠</td><td>

WARNING

Take suitable precautions to prevent transmission elements from being touched. If the CombiDrive® is started up without a transmission element attached, the featherkey must be secured in position to prevent it from flying off while the shaft is rotating.
</td></tr>
</table>

Please check the following prior to commissioning:

- The rotor turns freely without rubbing.

- The motor is assembled and aligned properly.

- The transmission elements are adjusted correctly (e.g. belt tension) and the transmission element is suitable for the given operating conditions.

- All electrical connections, mounting screws and connecting elements are tightened and fitted correctly.

- All protective conductors are installed properly.

- Any auxiliary equipment that might be fitted (e.g. brakes) is in working order.

- Protection guards are installed around all moving and live parts.

- The maximum speed *(see rating plate)* is not exceeded. Note that the maximum speed is the highest operating speed permitted for short periods. Remember that motor noise and vibration are worse at this speed and bearing life is reduced.

The above list is not meant to be exhaustive - additional checks may also be required.

CombiDrive® – Dimension (Only dimensions of the motor, total dimensions of the gear motor see MGS-catalog, Impr.-No. 440 637)
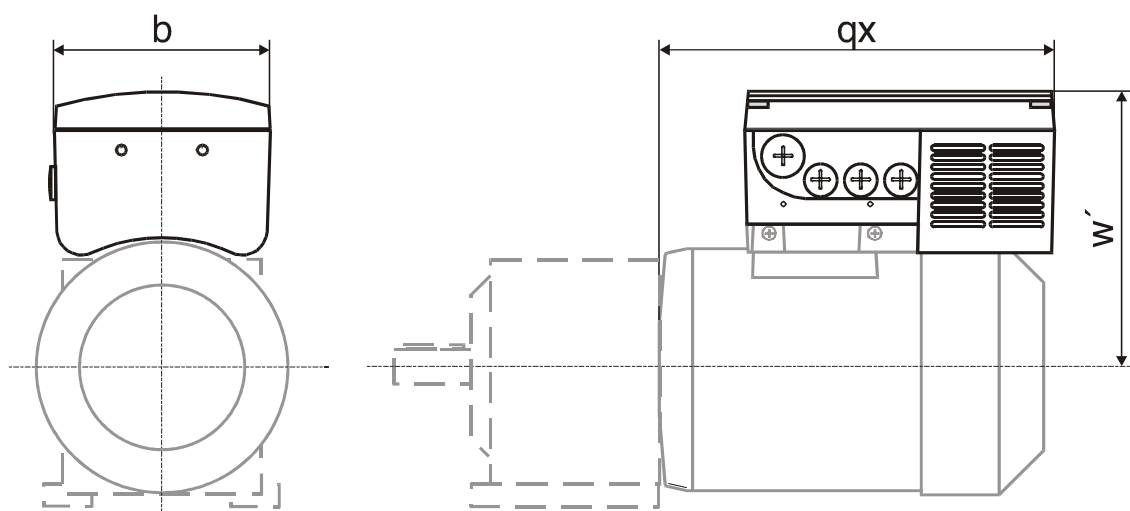
qx = Max. dimension; Given either through the inverter or through the fan cowl.

	Motor-type	Motor output rating	Inverter type	Width (b)	Dimension w´	qx
single-phase	71 K	0,25 kW	PM 25/1	122	182	237
	71 L	0,37 kW	PM 37/1	122	182	237
	80 K	0,55 kW	PM 55/1	122	193	259,5
	80 L	0,75 kW	PM 75/1	122	193	259,5

	Motor-type	Motor output rating	Inverter type	Width (b)	Dimension w´	qx
three-phase	71 L	0,37 kW	PM 37/3	122	182	237
	80 K	0,55 kW	PM 55/3	122	193	259,5
	80 L	0,75 kW	PM 75/3	122	193	259,5
	90 K	1,1 kW	PM 110/3	171	201	296
	90 L	1,5 kW	PM 150/3	171	201	296
	100 K	2,2 kW	PM 220/3	171	234	328,5
	100 L	3,0 kW	PM 300/3	171	234	328,5
	112 K	4,0 kW	PM 400/3	171	248,5	353
	132 K	5,5 kW	PM 550/3	171	264,5	372,5
	132 L	7,5 kW	PM 750/3	171	264,5	372,5

Dimension in mm

Installation notes

The position of the inverter related to the gearbox, see MGS-catalog (Impr.-No. 440 637).
The rotation of the terminal box is not possible.

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2.3 Electrical Installation

Remove the four M5 cross-head screws on the inverter's cover to access the electrical terminals *(see Figure 3 and Figure 4)*.

Notes: (1)   Refer to the electrical data table for cable sizes *(see section 6)*.

         (2)   We recommend introducing a `drip loop' when connecting the mains and control cables *(see Figure 5)*.

⚠️	# CAUTION
	The printed circuit boards contain CMOS components that are particularly sensitive to static electricity. For this reason, avoid touching the boards or components with your hands or metal objects.
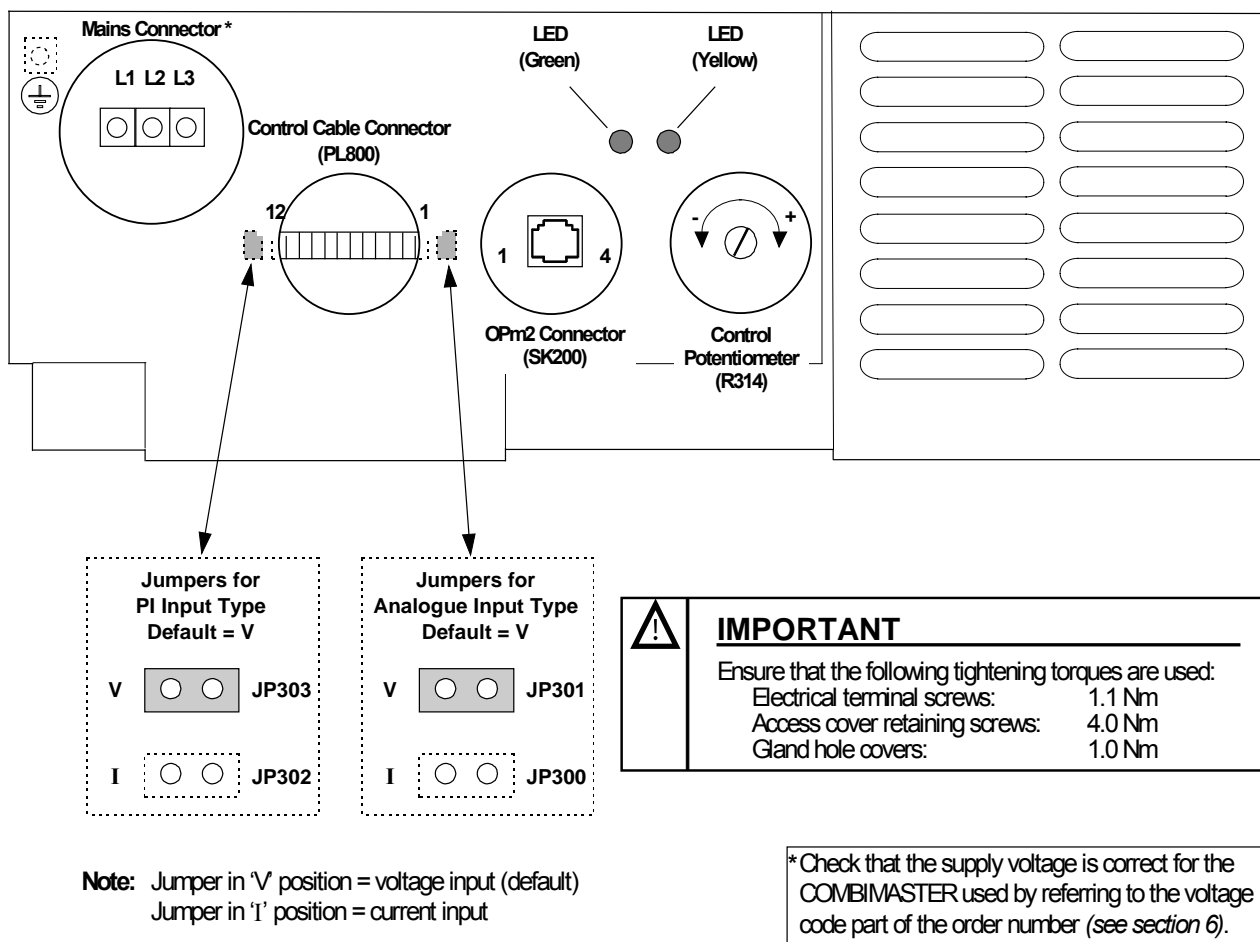

Note: Jumper in 'V' position = voltage input (default)
             Jumper in 'I' position = current input

⚠️ **IMPORTANT**

Ensure that the following tightening torques are used:
Electrical terminal screws: 1.1 Nm
Access cover retaining screws: 4.0 Nm
Gland hole covers: 1.0 Nm

* Check that the supply voltage is correct for the COMBIMASTER used by referring to the voltage code part of the order number *(see section 6)*.

Figure 1: Electrical Connection Diagram

2.3.1 Mains Cable Connections

Ensure that the power source supplies the correct voltage and is designed for the necessary current. Ensure that the appropriate circuit-breakers with the specified current rating are connected between the power supply and CombiDrive® *(see section 6)*.

Use Class 1 60/75°C copper wire only.

Use a 4-core screened cable *(for cross-section of each core see section 6)*. If crimp terminals are used then they must be insulated. If crimps are not used, the strip length must not exceed 5 mm.

Feed the power cable into the inverter via the gland hole nearest to the motor shaft *(see Figure 3)*. Connect the power leads to terminals L1, L2, L3 and the separate earth.

Use a 4 - 5 mm cross-tip screwdriver to tighten the terminal screws.

2.3.2 Control Cable Connections

⚠️ # CAUTION

The control and power supply cables <u>must</u> be laid separately. They must not be fed through the same cable conduit/trunking.

Use screened cable for the control lead.

Feed the control cable into the inverter via the appropriate gland hole *(see Figure 3).* Unplug connector block PL800 from the PCB and connect the control wires in accordance with the information given in Figures 4a and 4b *(also see Figure 3).*

IMPORTANT: A wire link **must** be fitted between control terminals 5 (DIN1) and 8 (P15+) otherwise the CombiDrive® will not operate when control potentiometer R314 is used. The wire link must be removed when operation via a run/stop switch is required.

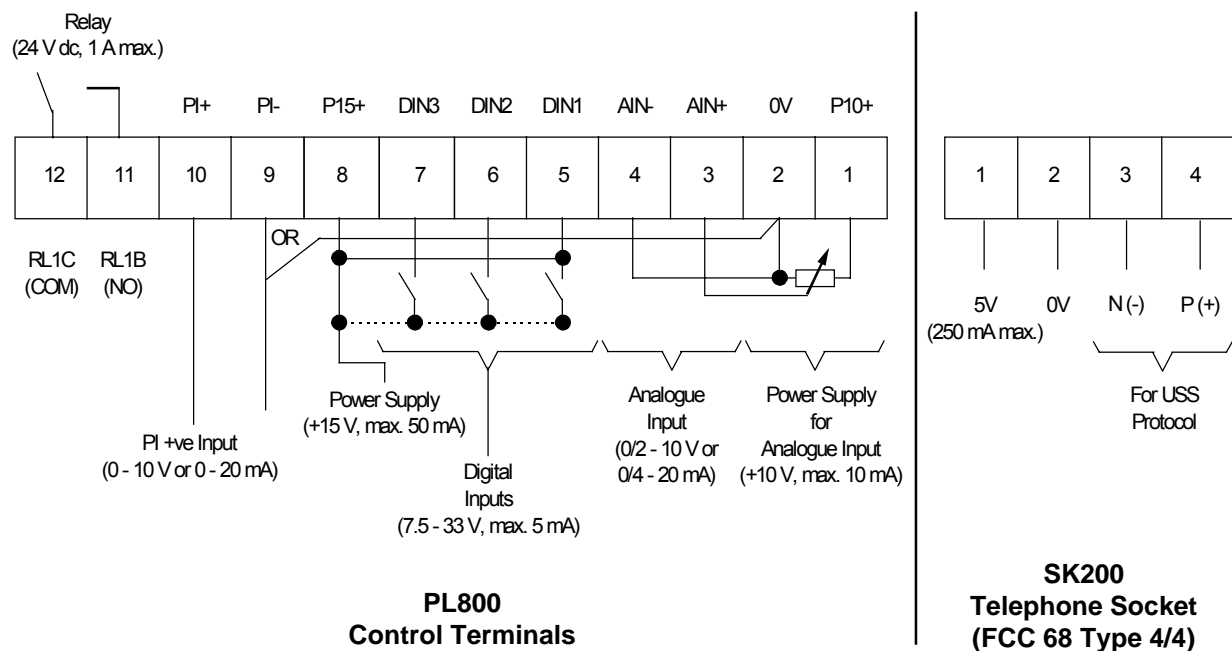Plug the connector block back into the PCB, refit the cover and tighten the four securing screws.

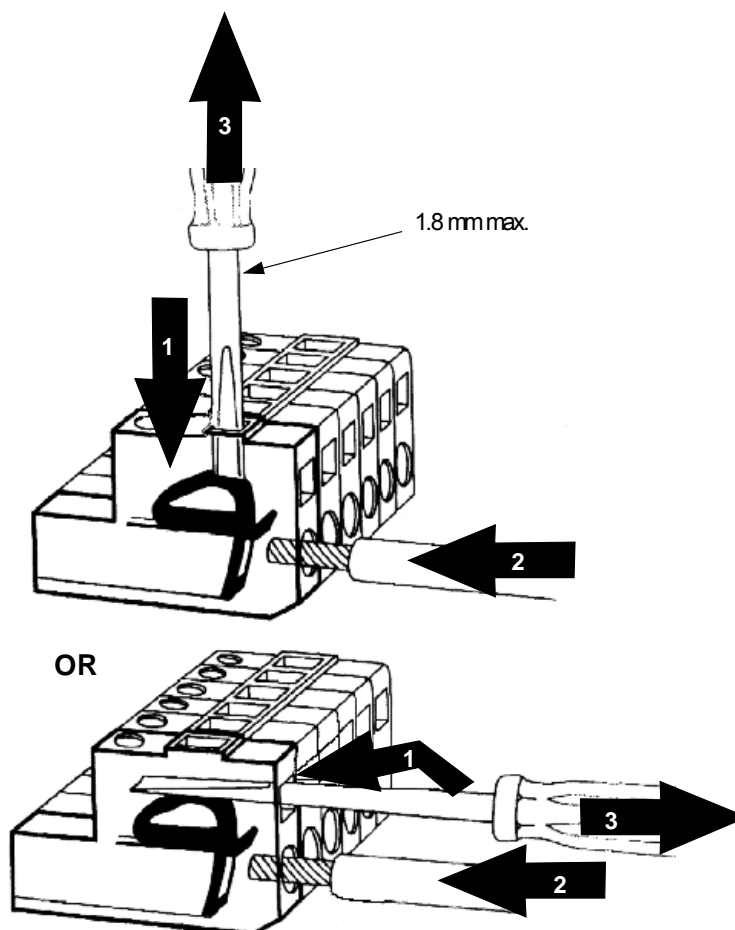*Figure 4a: Control Terminal Connections*

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1.8 mm max.

Figure 4b: Connecting Control Wires to PL800
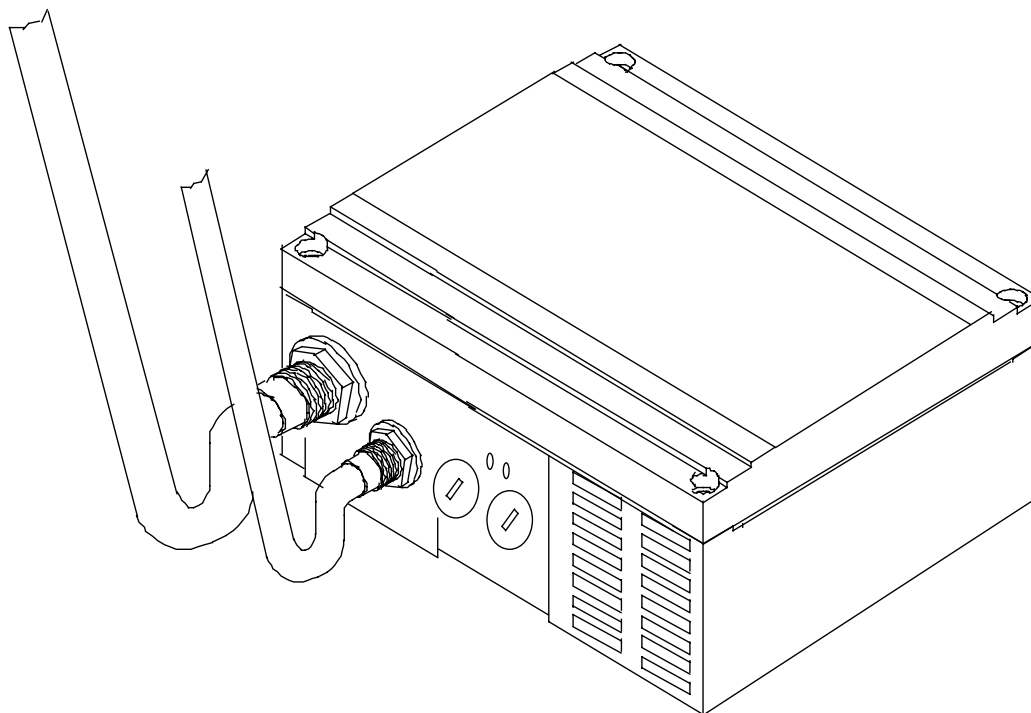
Figure 2: Cable Connections with Drip Loop

2.3.3 Block Diagram

Figure 3: Block Diagram

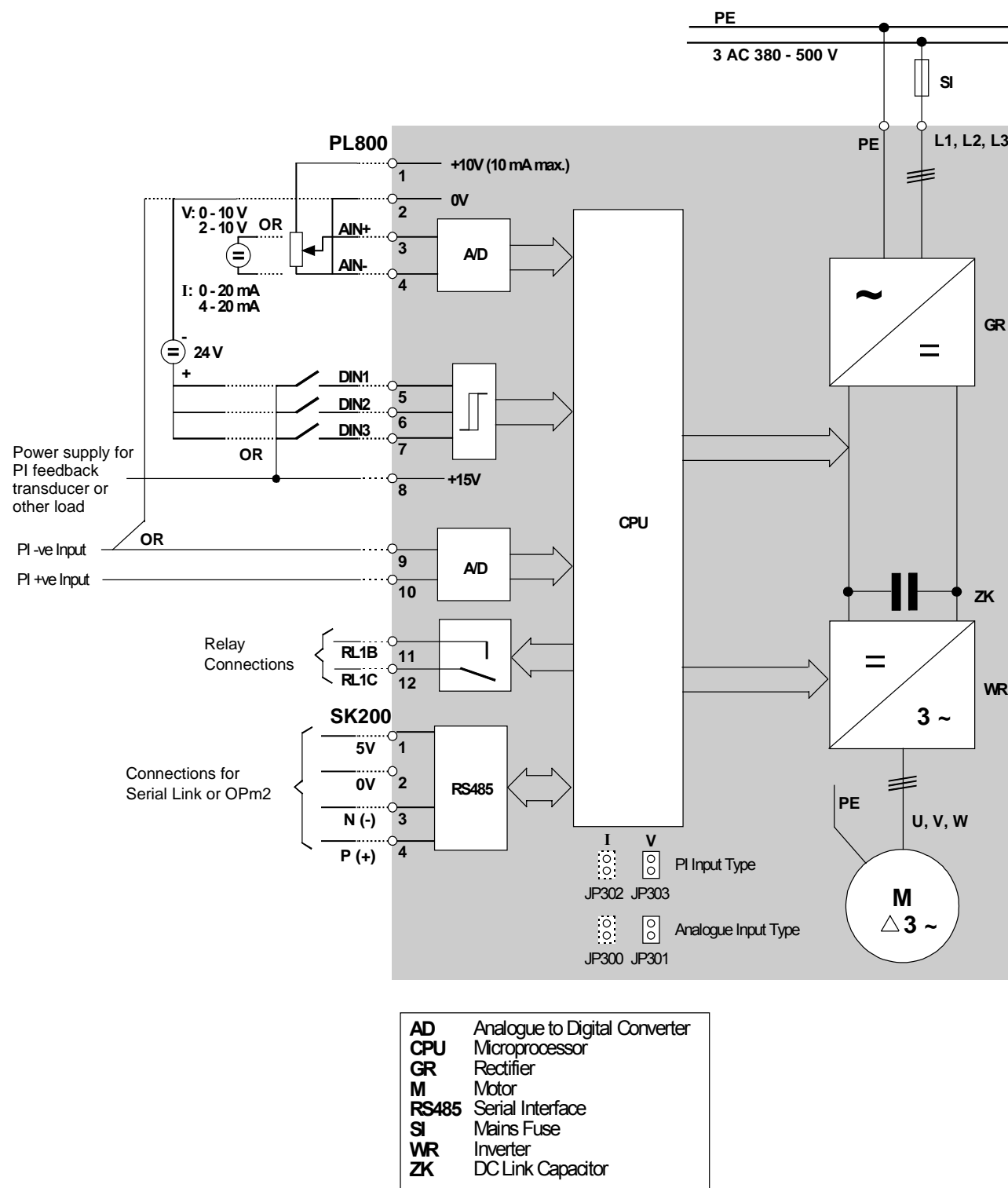|	
AD	Analogue to Digital Converter
CPU	Microprocessor
GR	Rectifier
M	Motor
RS485	Serial Interface
SI	Mains Fuse
WR	Inverter
ZK	DC Link Capacitor

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3. OPERATING INFORMATION

<table>
<tr>
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WARNING

The equipment must not be switched on until after its cover has been fitted and the cover screws have been tightened to the correct torque.

After the power has been turned off, you must always wait one minute so that the dc-link capacitors can discharge. Do not remove the cover until this time has elapsed.

All settings must only be entered by qualified personnel, paying particular attention to the safety precautions and warnings.

</td>
</tr>
</table>

3.1 General

(1)   The CombiDrive® does not have a main power switch and is therefore live when the mains supply is connected.

(2)   When delivered, the inverter has a frequency setpoint range of between 0 Hz and 50 Hz. Regardless of its initial position, internal potentiometer R314 must be turned fully counter-clockwise before the CombiDrive® can be started.

R314 can be accessed by removing the right-hand gland hole cover *(see Figure 3)*.

(3)   Parameter settings can only be changed by using either the serial interface (SK200) or an optional Clear Text Display (OPm2). Refer to the parameter list in section 4 for a full description of each available parameter.

Connecting a serial link or the OPm2 to the serial interface is made simple by removing the appropriate gland hole cover *(see Figure 3)* and plugging a suitably terminated interface cable into the telephone socket (SK200).

(4)   Analogue input type selection is determined by jumpers JP300 and JP301. JP300 closed selects current input, JP301 closed (default) selects voltage input. These jumpers can only be accessed while the cover is removed *(see Figure 3)*.

(5)   If the CombiDrive® is run unloaded (e.g. for test purposes) and vibration or trip conditions occur, change P077 from 0 to 1 (requires OPm2).

3.2 Basic Operation

There are two basic modes of operation for the CombiDrive®. Neither mode requires the use of an OPm2 or serial link connection:

(1)   Using the internal potentiometer only:

(a) For forward rotation, ensure that a link is fitted between DIN1 (pin 5) and P15+ (pin 8) on PL800 *(see Figure 4a)*. For reverse rotation, connect the link to DIN2 (pin 6) instead of DIN1.

(b) Apply mains power. The green and yellow LEDs will illuminate to show that power is applied. Turn potentiometer R314 fully counter-clockwise, otherwise the CombiDrive® cannot be started.

(c) Turn the potentiometer clockwise until the yellow LED extinguishes. This indicates that power is now applied to the motor. Continue turning clockwise to increase the speed of the motor.

(d) Turn the potentiometer counter-clockwise to reduce the speed of the motor. Turning the potentiometer fully counter-clockwise causes the motor to slow to a complete stop. Check that both LEDs are illuminated (STANDBY mode).

(2)   *Using a combination of the internal potentiometer and a run/stop switch:*

(a)   Connect a run/stop switch between DIN1 (pin 5) and P15+ (pin 8) on PL800 *(see Figure 4a) if* forward rotation is required. If reverse rotation is required instead, connect the switch to DIN2 (pin 6) instead of DIN1.

IMPORTANT
In either case, if a link has been fitted between pin 5 and pin 8 it **must** be removed before the run/stop switch is fitted.

(b)   Apply mains power. The green and yellow LEDs will illuminate to show that power is applied.

(c)   Set the external run/stop switch to ON.

(d)   Turn potentiometer R314 clockwise to set the required motor speed.

(e)   Stop the motor by setting the external on/off switch to OFF. When the switch is set to ON again, it will run at the speed previously set using the potentiometer.

3.3 Operation - External Analogue Control

The method of setting up the CombiDrive® for use with external analogue voltage control is described below. This method can use both the internal potentiometer and external analogue voltage control. It does not require the use of an OPm2 or serial link connection.

(1) Connect a 4.7 kΩ potentiometer to the control terminals as shown in Figure 3 or connect pin 2 (0V) to pin 4 (AIN-) and a 0 - 10 V signal between pin 2 (0V) and pin 3 (AIN+).

(2) Ensure that a link is fitted between pin 5 (DIN1) and pin 8 (P15+).

(3) Check that voltage input is selected by ensuring that the jumper is fitted to JP301.

(4) Refit the cover, tighten the cover screws to the correct torque and then apply mains power to the inverter.

(5) Turn the external potentiometer (or adjust the analogue control voltage) until the desired frequency is achieved. The unit will not switch on until a minimum of 2 V has been applied.

Note
The frequency set by the external voltage is added to the frequency set by the internal potentiometer.

As with Basic Operation (2), a run/stop switch can be used to start and stop the motor, or the direction of rotation can be changed by connecting the link to DIN2 instead of DIN1.

3.4 Operation - Digital Control

This method of operation requires either a Clear Text Display (OPm2) or a serial link connection. For a basic startup configuration using digital control, proceed as follows:

(1) Remove the link that connects control terminal 5 to terminal 8 (if one has been fitted).

(2) Connect control terminal 5 to terminal 8 via a simple on/off switch. This sets up the inverter for clockwise rotation (default). If counter-clockwise operation is required, connect a switch between control terminals 6 and 8.

(3) Connect the OPm2 or serial link to SK200. Refit the cover, tighten the cover screws to the correct torque and then apply mains power to the inverter.

(4) Set parameter P006 to 000 to specify digital setpoint.

(5) Set parameter P005 to the desired frequency setpoint.

(6) Set the external on/off switch to ON or press the ON button on the OPm2 (set P007 = 001 to use the OPm2). The CombiDrive® will now run at the frequency set by P005.

3.5 Stopping the Motor

Via the external on/off switch: setting the switch to OFF overrides the setting on the potentiometer and causes the motor to come to a controlled stop**.**

Via the potentiometer: turning the potentiometer counter-clockwise until the input voltage drops below 1 V causes the motor to slow to a stop.

3.6 If the Motor Does Not Start Up

Check the LEDs on the side of the inverter:

LED State		CombiDrive® Status
Green	Yellow	
ON	ON	Mains power on, CombiDrive® not running (STANDBY)
ON	OFF	CombiDrive® running, as per control commands (ON)
Flashing	Flashing	Current limit warning
Flashing	ON	CombiDrive® overtemperature
ON	Flashing	Motor overtemperature
OFF	ON	Other fault (e.g. tripped)
OFF	Flashing	Mains undervoltage
OFF	OFF	Mains supply fault (e.g. faulty external switch)

If a fault occurs: switch off, disconnect and then reconnect the power and then switch on again. Switch off if the fault condition persists. Trips can be reset by connecting a switch to DIN3 *(see parameter P053)*.

If a warning occurs: switch off, disconnect and reconnect the power and then switch on again.

In either of the above cases, if the fault/warning persists then further investigation requires an OPm2 or a serial link connection.

3.7 Local and Remote Control

The inverter can be controlled either locally (default), or remotely via a USS data line connected to the internal RS485 telephone socket (SK200).

When local control is used (P910 = 0), the motor can only be controlled via the internal potentiometer or the control terminals. Control commands, setpoints or parameter changes received via the RS485 interface have no effect.

For remote control, the serial interface is designed as a 2-wire connection for bi-directional data transmission. Refer to parameter P910 in section 4 for the available remote control options.

When operating via remote control the inverter will not accept control commands from the terminals. *Exception: OFF2 or OFF3 can be activated via parameter P051 to P053 (refer to parameters P051 to P053 in section 4).*

Several CombiDrive® can be connected to an external control unit at the same time and can be addressed individually.

Note: If the inverter has been set up to operate via the serial link but does not run when an ON command is received, try reversing the connections to terminals 3 and 4 on SK200.

For further information, refer to the following documents:

E20125-B0001-S302-A1	Application of the USS Protocol in SIMOVERT Units 6SE21 and MICROMASTER (German)
E20125-B0001-S302-A1-7600	Application of the USS Protocol in SIMOVERT Units 6SE21 and MICROMASTER (English)

3.8 Closed Loop Control

Closed loop control is only possible when an OPm2 or a serial link is connected to the CombiDrive®.

3.8.1 General Description

The CombiDrive® provides a Proportional/Integral (PI) control function for closed loop control *(see Figure 7)*. PI control is ideal for temperature or pressure control, or other applications where the controlled variable changes slowly or where transient errors are not critical. This control loop is **not** suitable for use in systems where fast response times are required.

Note: The closed loop function is not designed for speed control, but can be used for this provided that fast response times are not required.

When closed loop PI control is enabled (P201 = 002), all setpoints are calibrated between zero and 100%, i.e. a setpoint of 50.0 = 50%. This allows general purpose control of any process variable that is actuated by motor speed and for which a suitable transducer is available.
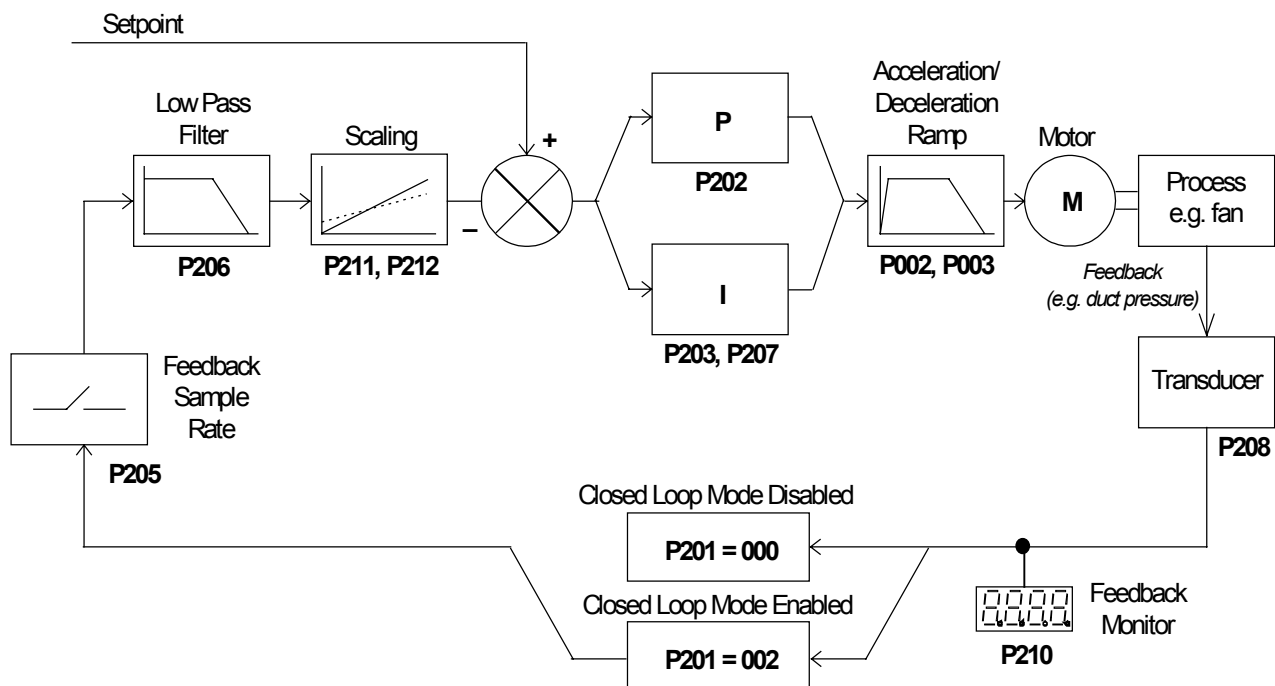

Figure 7: Closed Loop Control

3.8.2 Hardware Setup

Connect the signal wire from the external feedback transducer to control terminal 10. Set jumper JP303 if voltage input type is required (default) or set JP302 if current input type is required.

15 V dc power for the feedback transducer can be supplied from control terminal 8.

3.8.3 Parameter Settings

Closed loop control cannot be used unless P201 is first set to 001. Most of the parameters associated with closed loop control are shown in Figure 7. Other parameters which are also associated with closed loop control are as follows:

> **P001** (value = 007)
> **P061** (value = 012 or 013)
> **P210**
> **P220**

Descriptions of all closed loop control parameters are provided in section 4. For further detailed information about PI operation, refer to the Siemens DA 64 Catalogue.
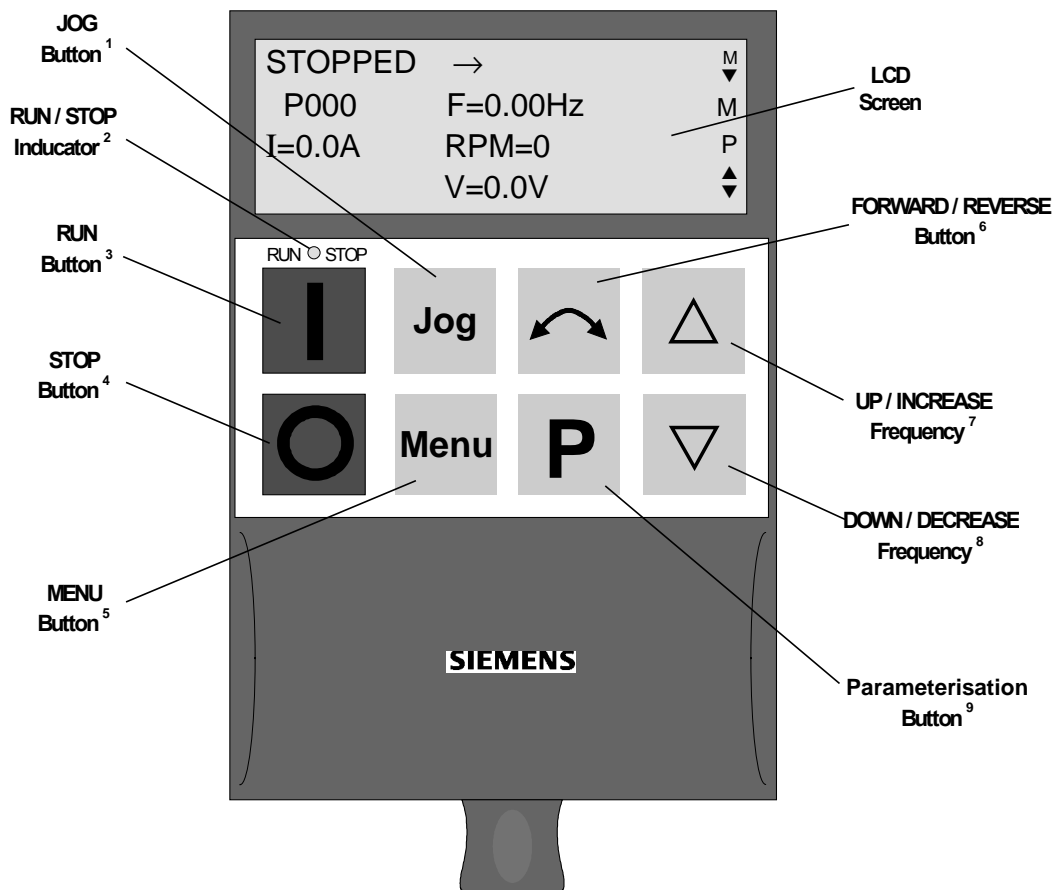
4. CLEAR TEXT DISPLAY MODULE & SYSTEM PARAMETERS

4.1 Clear Text Display Module (OPm2)

This section only applies for users who intend using the optional Clear Text Display module (OPm2) to control the operation of the CombiDrive®.

The OPm2 module provides a multi-language user-friendly interface to the CombiDrive®. The display is menu-driven and provides information in simple text form. It also includes built-in context-sensitive Help screens.

As well as enabling direct control of the motor, the OPm2 extends the functionality of the CombiDrive® by providing access to a comprehensive range of adjustable parameters. Setting these parameters will allow you to customise the operation of the CombiDrive® to meet almost any application requirement.

[1] Pressing this button while the motor is stopped causes it to start and run at the preset jog frequency. The motor stops as soon as the button is released. Pressing this button while the motor is running has no effect. Disabled if P007 or 123 = 0.

[2] *Green* indicates that the motor is running.
Flashing green indicates that the motor is ramping up or down.
Red indicates that the motor is stationary.
Flashing red indicates a fault condition.

[3] Press to start the inverter. Disabled if P007 or P121 = 0.

[4] Press to stop the inverter.

[5] Changes the display to show the menu options. Pressing and holding this button down and then pressing the ∇ button causes the Help screen to be displayed.

[6] Press to change the direction of rotation of the motor. REVERSE is indicated by a minus sign (values <100) or a flashing decimal point (values > 100). Disabled if P007 or P122 = 0.

[7] Press to INCREASE frequency. Used to change parameter numbers or values to higher settings during the parameterisation procedure. Disabled if P124 = 0.

[8] Press to DECREASE frequency. Used to change parameter numbers or values to lower settings during the parameterisation procedure. Disabled if P124 = 0.

[9] Press to access parameters. Disabled if P051 - P053 = 14 when using digital inputs.

Figure 8: Clear Text Display Module (OPm2)

4.2 System Parameters

The parameters listed here can only be accessed via the OPm2 or a serial link to the CombiDrive®. If the CombiDrive® is to be operated only using analogue control within the 0 - 50 Hz frequency range then access to these parameters is not required.

Note: The control buttons on the OPm2 (RUN, REVERSE and JOG) are disabled by default and cannot be used until P007 has been set to '1'.
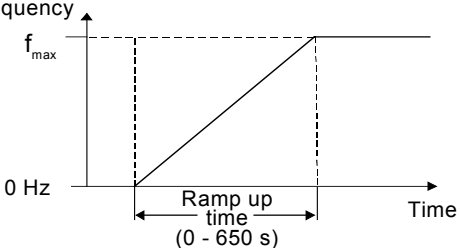
Access to parameters is determined by the value set in P009. Check that the key parameters necessary for your application have been programmed.
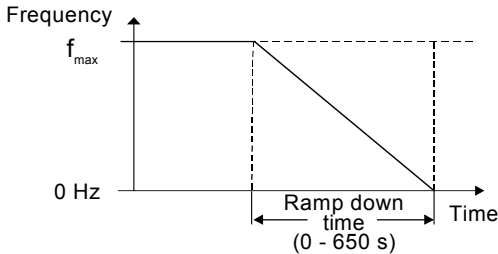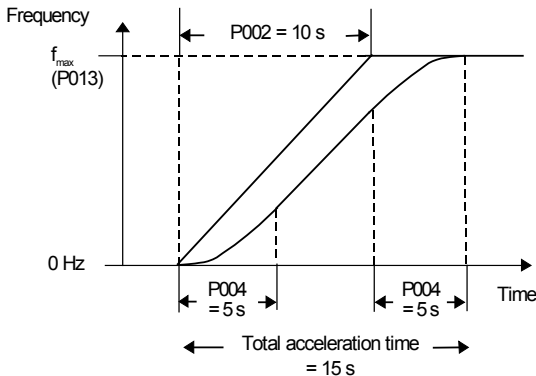
P009 options are:

> **0** = Only the parameters from P001 to P009 can be read and set.
> **1** = Parameters P001 to P009 can be set and all other parameters can only be read.
> **2** = All parameters can be set, but P009 resets to 0 the next time power is removed from the inverter.
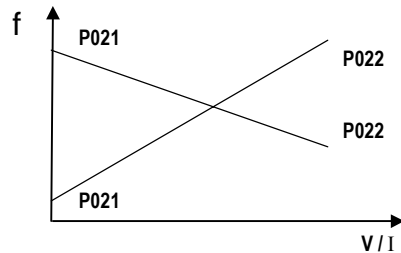> **3** = All parameters can always be set.

Note: In the following parameter table:
> '•'   Indicates parameters that can be changed during operation.
> '☆☆☆'   Indicates that the value of this factory setting depends on the rating of the motor.

Parameter	Function	Range [Default]	Description / Notes
P000	Operating display	-	This displays the output selected in P001 on the second line of the LCD screen.
			If output frequency has been selected (P001 = 0) and the inverter is OFF, the display alternates between the current frequency (F) and the frequency that the inverter will run at when the RUN button is pressed (S). If P001 is set to any other value then only the actual value is displayed on this line of the display.
			In the event of a fault, the relevant fault code (Fxxx) is displayed *(see section 5)*. In the event of a warning the display flashes.
P001 •	Display mode	0 - 8 [0]	Display selection:
			0 = Output frequency (Hz)
			1 = Frequency setpoint (i.e. speed at which inverter is set to run) (Hz)
			2 = Motor current (A)
			3 = DC-link voltage (V)
			4 = Motor torque (% nominal)
			5 = Motor speed (RPM)
			6 = USS status *(see section 7.2)*
			7 = Closed loop control setpoint (% of full scale)
			8 = Output voltage
P002 •	Ramp up time (seconds)	0 - 650.00 [10.00]	This is the time taken for the motor to accelerate from standstill to the maximum frequency as set in P013.
			Setting the ramp up time too short can cause the inverter to trip (fault code F002 - overcurrent).

Parameter	Function	Range [Default]	Description / Notes
P003 ●	Ramp down time (seconds)	0 - 650.00 [25.00]	This is the time taken for the motor to decelerate from maximum frequency (P013) to standstill. Setting the ramp down time too short can cause the inverter to trip (fault code F001 - overvoltage). This is also the period for which DC injection braking is applied (*see P073*) Frequency f_{max} 0 Hz — Ramp down time (0 - 650 s) — Time
P004 ●	Smoothing (seconds)	0 - 40.0 [0.0]	Used to smooth the acceleration/deceleration of the motor (useful in applications where it is important to avoid 'jerking', e.g. conveyor systems, textiles, etc.). Smoothing is only effective if the ramp up/down time exceeds 0.3 s. Frequency — P002 = 10 s — f_{max} (P013) — 0 Hz — P004 = 5 s — P004 = 5 s — Time — Total acceleration time = 15 s **Note:** The smoothing curve for deceleration is based on the ramp up gradient (P002) and is added to the ramp down time set by P003. Therefore, the ramp down time is affected by changes to P002.
P005 ●	Digital frequency setpoint (Hz)	0 - 120.00 [50.00]	Sets the frequency that the inverter will run at when operated in digital mode. Only effective if P006 set to '0'.
P006	Frequency setpoint source selection	0 - 2 [1]	Sets the control mode of the inverter. **0** = Digital. The inverter runs at the frequency set in P005. If P007 is set to zero, the frequency may be adjusted by setting any two of digital inputs P051 - P053 to values of 11 and 12. **1** = Analogue. The frequency is set via an analogue input signal or the internal potentiometer. **2** = Fixed frequency or motor potentiometer. Fixed frequency is only selected if the value of at least one binary input (P051 - P053) = 6, 17 or 18. **Notes:** (1) If P006 = 1 and the inverter is set up for remote control operation, the analogue inputs remain active (added to the serial setpoint). (2) Motor potentiometer setpoints via digital inputs are stored when P011 = 1.

Parameter	Function	Range [Default]	Description / Notes
P007	Keypad control	0 - 1 [0]	**0** = The RUN, REVERSE and JOG buttons are disabled. Control is via digital inputs *(see parameters P051 - P053)*. Δ and ∇ may still be used to control frequency provided that P124 = 1 and a digital input has not been selected to perform this function. **1** = OPm2 buttons are enabled (can be individually disabled depending on the setting of parameters P121 - P124). The digital inputs for RUN, JOG and Δ / ∇ are disabled.
P009 ●	Parameter protection setting	0 - 3 [0]	Determines which parameters can be adjusted: **0** = Only parameters from P001 to P009 can be read/set. **1** = Parameters from P001 to P009 can be set and all other parameters can only be read. **2** = All parameters can be read/set but P009 automatically resets to 0 when power is removed. **3** = All parameters can be read/set.
P011	Frequency setpoint memory	0 - 1 [0]	**0** = Disabled **1** = Enabled. The setpoint alterations made with the Δ / ∇ buttons or digital inputs are stored even when power has been removed from the inverter.
P012 ●	Minimum motor frequency (Hz)	0 - 120.00 [0.00]	Sets the minimum motor frequency (must be less than the value of P013).
P013 ●	Maximum motor frequency (Hz)	0 - 120.00 [50.00]	Sets the maximum motor frequency.
P014 ●	Skip frequency 1 (Hz)	0 - 120.00 [0.00]	A skip frequency can be set with this parameter to avoid the effects of mechanical resonance. Frequencies within +/-(value of P019) of this setting are suppressed. Stationary operation is not possible within the suppressed frequency range - the range is just passed through.
P015 ●	Automatic restart after mains failure.	0 - 1 [0]	Setting this parameter to '1' enables the inverter to restart automatically after a mains break or 'brownout', provided the run/stop switch is still closed or the link is fitted, P007 = 0 and P910 = 0, 2 or 4. **0** = Disabled **1** = Automatic restart
P016 ●	Start on the fly	0 - 2 [0]	Allows the inverter to start onto a spinning motor. Under normal circumstances the inverter runs the motor up from 0 Hz. However, if the motor is still spinning or is being driven by the load, it will undergo braking before running back up to the setpoint - this can cause an overvoltage trip. By using a flying restart, the inverter ramps up the output voltage at the setpoint for the period defined by P020. **0** = Normal restart **1** = Flying restart after power up, fault or OFF2 (if P018 = 1). **2** = Flying restart every time (useful in circumstances where the motor can be driven by the load).
P017 ●	Smoothing type	1 - 2 [1]	**1** = Continuous smoothing (as defined by P004). **2** = Discontinuous smoothing. This provides a fast unsmoothed response to STOP commands and requests to reduce frequency. **Note:** P004 must be set to a value > 0.0 for this parameter to have any effect.

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Parameter	Function	Range [Default]	Description / Notes
P018 ●	Automatic restart after fault	0 - 1 [0]	Automatic restart after fault: **0** = Disabled **1** = The inverter will attempt to restart up to 5 times after a fault. If the fault is not cleared after the 5th attempt, the inverter will remain in the fault state until reset. There is an increasing time delay between each restart attempt.
P019 ●	Skip frequency bandwidth (Hz)	0 - 10.00 [2.00]	Frequencies set by P014, P027, P028 or P029 that are within +/- the value of P019 are suppressed.
P020	Flying start ramp time (seconds)	0.50 - 25.0 [5.0]	Used in conjunction with P016 (set longer times if persistent F002 trips occur).
P021 ●	Minimum analogue frequency (Hz)	0 - 120.00 [0.00]	Frequency corresponding to the lowest analogue input value, i.e. 0 V / 0 mA or 2 V / 4 mA. This can be set to a higher value than P022 to give an inverse relationship between analogue input and frequency output *(see diagram in P022)*.
P022 ●	Maximum analogue frequency (Hz)	0 - 120.00 [50.00]	Frequency corresponding to the highest analogue input value, i.e. 10 V / 20 mA, determined by P023. This can be set to a lower value than P021 to give an inverse relationship between analogue input and frequency output. i.e. **Note:** The output frequency is limited by values entered for P012/P013.
P023 ●	Analogue input type	0 - 2 [2]	Selects analogue input type according to the setting of jumpers JP300/JP301: JP301 closed **OR** JP300 closed **0** = 0 V to 10 V 0 mA to 20 mA **1** = 2 V to 10 V 4 mA to 20 mA **2** = [2 V* to 10 V] 4 mA* to 20 mA * The inverter will come to a controlled stop if V < 1 V or 2 mA. **WARNING:** **The motor can automatically run without a potentiometer or voltage source connected between pins 3 and 4.** **With P023=2, the motor will automatically start when V exceeds 2 V. This equally applies to analogue and digital control (i.e. P006 = 0 or 1).**
P024 ●	Analogue setpoint addition	0 - 2 [0]	If the inverter is not in analogue mode (P006 = 0 or 2), setting this parameter to '1' causes the analogue input value to be added. **0** = No addition. **1** = Addition of the analogue setpoint (defined by P023) to the fixed frequency or the motor potentiometer frequency. **2** = Scaling of digital/fixed setpoint by analogue input (P023) in the range 0 - 100%. **Note:** By selecting a combination of reversed negative fixed frequency settings and analogue setpoint addition, it is possible to configure the inverter for 'centre zero' operation with a +/-5 V supply or a 0 - 10 V potentiometer so that the output frequency can be 0 Hz at any position, including the centre position.

Parameter	Function	Range [Default]	Description / Notes
P027 ●	Skip frequency 2 (Hz)	0 - 120.00 [0.00]	*See P014.*
P028 ●	Skip frequency 3 (Hz)	0 - 120.00 [0.00]	*See P014.*
P029 ●	Skip frequency 4 (Hz)	0 - 120.00 [0.00]	*See P014.*
P031 ●	Jog frequency right (Hz)	0 - 120.00 [5.00]	Jogging is used to advance the motor by small amounts. It is controlled via the JOG button or with a non-latching switch on one of the digital inputs (P051 to P053). If jog right is enabled (DINn = 7), this parameter controls the frequency at which the inverter will run when the switch is closed. Unlike other setpoints, it can be set lower than the minimum frequency.
P032 ●	Jog frequency left (Hz)	0 - 120.00 [5.00]	If jog left is enabled (DINn = 8), this parameter controls the frequency at which the inverter will run when the switch is closed. Unlike other setpoints, it can be set lower than the minimum frequency.
P035	Reverse motor direction	0 - 1 [0]	**0** = Normal direction control. **1** = Direction control is reversed.
P041 ●	Fixed frequency 1 (Hz)	0 - 120.00 [5.00]	Valid if P006 = 2 and P053 = 6 or 18 or P051 = P052 = P053 = 17.
P042 ●	Fixed frequency 2 (Hz)	0 - 120.00 [10.00]	Valid if P006 = 2 and P052 = 6 or 18 or P051 = P052 = P053 = 17.
P043 ●	Fixed frequency 3 (Hz)	0 - 120.00 [15.00]	Valid if P006 = 2 and P051 = 6 or 18 or P051 = P052 = P053 = 17.
P044 ●	Fixed frequency 4 (Hz)	0 - 120.00 [20.00]	Valid if P006 = 2 and P051 = P052 = P053 = 17.

P045 — Inversion fixed setpoints for fixed frequencies 1 - 4 — Range 0 - 7 [0]

Sets the direction of rotation for the fixed frequency:

	FF 1	FF 2	FF 3	FF 4
P045 = 0	⇒	⇒	⇒	⇒
P045 = 1	⇐	⇒	⇒	⇒
P045 = 2	⇒	⇐	⇒	⇒
P045 = 3	⇒	⇒	⇐	⇒
P045 = 4	⇒	⇒	⇒	⇐
P045 = 5	⇐	⇐	⇒	⇒
P045 = 6	⇐	⇐	⇐	⇒
P045 = 7	⇐	⇐	⇐	⇐

⇒ Fixed setpoints not inverted.
⇐ Fixed setpoints inverted.

Parameter	Function	Range [Default]	Description / Notes
P046 ●	Fixed frequency 5 (Hz)	0 - 120.00 [25.00]	Valid if P006 = 2 and P051 = P052 = P053 = 17.
P047 ●	Fixed frequency 6 (Hz)	0 - 120.00 [30.00]	Valid if P006 = 2 and P051 = P052 = P053 = 17.
P048 ●	Fixed frequency 7 (Hz)	0 - 120.00 [35.00]	Valid if P006 = 2 and P051 = P052 = P053 = 17.

P050 — Inversion fixed setpoints for fixed frequencies 5 - 7 — Range 0 - 7 [0]

Sets the direction of rotation for the fixed frequency:

	FF 5	FF 6	FF 7
P050 = 0	⇒	⇒	⇒
P050 = 1	⇐	⇒	⇒
P050 = 2	⇒	⇐	⇒
P050 = 3	⇒	⇒	⇐
P050 = 4	⇒	⇒	⇒
P050 = 5	⇐	⇐	⇒
P050 = 6 or 7	⇐	⇐	⇐

⇒ Fixed setpoints not inverted.
⇐ Fixed setpoints inverted.

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Parameter	Function	Range [Default]	Description / Notes

P051 — Selection control function, DIN1 (terminal 5), fixed frequency 3 or binary fixed frequency bit 0. — Range 0 - 19 [1]

P052 — Selection control function, DIN2 (terminal 6), fixed frequency 2. or binary fixed frequency bit 1. — Range 0 - 19 [2]

P053 — Selection control function, DIN3 (terminal 7), fixed frequency 1 or binary fixed frequency bit 2. — Range 0 - 19 [10]

Value	Function of P051 to P053	Function, low state	Function, high state
0	Input disabled	-	-
1	ON right	Off	On right
2	ON left	Off	On left
3	Reverse	Normal	Reverse
4	OFF2 *	OFF2	On
5	OFF3 *	OFF3	On
6	Fixed frequencies 1 - 3	Off	On
7	Jog right	Off	Jog right
8	Jog left	Off	Jog left
9	Remote operation	Local	Remote
10	Fault code reset	Off	Reset on rising edge
11	Increase frequency **	Off	Increase
12	Decrease frequency **	Off	Decrease
13	Disable analogue input (setpoint is 0.0 Hz)	Analogue on	Analogue disabled
14	Disable the ability to change parameters	'P' Enabled	'P' Disabled
15	Enable dc brake	Off	Brake on
16	*Do not use*	-	-
17	Binary fixed frequency control (fixed frequencies 1 - 7)	Off	On
18	As 6, but input high will also request RUN *	Off	On
19	External trip/PTC	Yes (F012)	No

* *See section 3.7.*
** *Only effective when P007 = 0.*

Binary Coded Fixed Frequency Mapping
(P051, P052, P053 = 17)

	DIN3 (P053)	DIN2 (P052)	DIN1 (P051)
STOP	0	0	0
RUN to FF1 (P041)	0	0	1
RUN to FF2 (P042)	0	1	0
RUN to FF3 (P043)	0	1	1
RUN to FF4 (P044)	1	0	0
RUN to FF5 (P046)	1	0	1
RUN to FF6 (P047)	1	1	0
RUN to FF7 (P048)	1	1	1

P056 — Digital input debounce time — Range 0 - 2 [0] — Use a fast response time only when a 'clean' input signal is used, e.g. from a PLC. Use a slow response time to allow filtering of the signal if a noisy input (e.g. a switch) is used.

0 = 12.5 ms
1 = 7.5 ms
2 = 2.5 ms

P058 ● — RUN command delay (seconds) — Range 0.0 - 650.0 [0.0] — Sets a time delay before the RUN command takes effect. This parameter affects run commands from all sources <u>except</u> the RUN button on the OPm2 (this activates the drive immediately)..

Parameter	Function	Range [Default]	Description / Notes
P061	Selection relay output RL1	0 - 13 [6]	

Value	Relay function	Active [4]
0	No function assigned (relay not active)	Low
1	Inverter is running	High
2	Inverter frequency 0.0 Hz	Low
3	Motor run right has been selected	High
4	External brake on (see parameters P063/P064) [1]	Low
5	Inverter frequency less than or equal to minimum frequency	Low
6	Fault indication [2]	Low
7	Inverter frequency greater than or equal to setpoint	High
8	Warning active [3]	Low
9	Output current greater than or equal to P065	High
10	Motor current limit (warning) [3]	Low
11	Motor over temperature (warning) [3]	Low
12	Closed loop motor LOW speed limit	High
13	Closed loop motor HIGH speed limit	High

[1] External brake requires 24 V (max.) dc slave relay.

[2] Inverter switches off *(see parameter P930 and section 5)*.

[3] Inverter does not switch off *(see parameter P931)*.

[4] 'Active low' = relay OPEN. 'Active high' = relay CLOSED.

Parameter	Function	Range [Default]	Description / Notes
P062	Electro-mechanical brake option control	0 - 4 [0]	This enables or disables the electro-mechanical brake option. Operation is the same as for P061 = 4, except that the brake control voltage is supplied directly. **0** = Disabled **1 - 3** = *Do not use* **4** = Enabled
P063	External brake release delay (seconds)	0 - 20.0 [1.0]	Only effective if the relay output is set to control an external brake (P061 = 4) or the electro-mechanical brake option is used (P062 = 4). In this case when the inverter is switched on, it will run at the minimum frequency for the time set by this parameter before releasing the brake control relay and ramping up *(see illustration in P064)*.
P064	External brake stopping time (seconds)	0 - 20.0 [1.0]	As P063, only effective if the relay output is set to control an external brake (P061 = 4) or the electro-mechanical brake option is used (P062 = 4). This defines the period for which the inverter continues to run at the minimum frequency after ramping down and while the external brake is applied.

A = Brake applied
B = Brake removed

Notes: (1) Settings for P063 and P064 should be slightly longer than the actual time taken for the external brake to apply and release respectively.

(2) Setting P063 or P064 to too high a value, especially with P012 set to a high value, can cause an overcurrent warning or trip as the inverter attempts to move a locked motor shaft.

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Parameter	Function	Range [Default]	Description / Notes
P065	Current threshold for relay (A)	0 - 99.9 [1.0]	This parameter is used when P061 = 9. The relay switches on when the motor current is greater than the value of P065 and switches off when the current falls to 90% of the value of P065 (hysteresis).
P071 ●	Slip compensation (%)	0 - 200 [0]	The inverter can estimate the amount of slip in an asynchronous motor at varying loads and increase its output frequency to compensate. This parameter `fine tunes' the compensation for different motors in the range 0 - 200% of the inverter's nominal estimate.
P072 ●	Slip limit (%)	0 - 500 [250]	This limits the slip of the motor to prevent `pull-out' (stalling), which can occur if slip is allowed to increase indefinitely. When the slip limit is reached, the inverter reduces the frequency until the level of slip is acceptable.
P073 ●	DC injection braking (%)	0 - 250 [0]	This stops the motor by applying a DC current. This causes heat to be generated in the motor rather than the inverter and holds the shaft stationary until the end of the braking period. Braking is effective for the period of time set by P003. The DC brake can be activated using DIN1 - DIN3 *(braking is active for as long as the DIN is high - see P051 - P053).* **WARNING:** **Frequent use of long periods of dc injection braking can cause the motor to overheat.** **If DC injection braking is enabled via a digital input then DC current is applied for as long as the digital input is high. This causes heat in the motor.**
P074 ●	I²t motor derating	0 - 1 [1]	**0** = Disabled **1** = Enabled. Causes an F074 trip if the motor I²t calculation reaches its limit. The time taken to trip is dependent on the difference between the overload current and the nominal motor current rating stored in P083 - typically a 150% overload will result in a switch-off in 1-2 minutes. **WARNING:** **For safety-critical applications, it is recommended that a motor PTC is used to protect the motor from overheating.**

P077	Control mode	0 - 2 [0]	Controls the relationship between the speed of the motor and the voltage supplied by the inverter.
			    0 = Linear voltage/frequency.
			        Use this curve for synchronous motors or motors connected in parallel.
			    1 = Linear voltage/frequency with energy saving.
			        Output voltage is reduced at low load (not recommended for dynamic loads).
			    2 = Quadratic voltage/frequency relationship.
			        This is suitable for centrifugal pumps and fans.

Parameter	Function	Range [Default]	Description / Notes
P078 ●	Continuous boost (%)	0 - 250 [100]	Operates continuously over the whole frequency range.
			For many applications it is necessary to increase low frequency torque. This parameter sets the start-up voltage at 0 Hz to adjust the available torque for low frequency operation. 100% setting will produce rated motor current at low frequencies.
			WARNING: **If P078 is set too high, overheating of the motor and/or an overcurrent trip (F002) can occur.**
P079 ●	Starting boost (%)	0 - 250 [0]	For drives which require a high initial starting torque, it is possible to set an additional current (added to the setting in P078) during ramping. This is only effective during initial start up and until the frequency setpoint is reached.
			Note: This increase is in addition to P078, but the total is limited to 250%.
P081	Nominal frequency for motor (Hz)	0 - 120.00 [☆☆☆]	
P082	Nominal speed for motor (RPM)	0 - 9999 [☆☆☆]	
P083	Nominal current for motor (A)	0.1 - 99.9 [☆☆☆]	'These parameters are set in the factory and should not be changed under normal circumstances.
P084	Nominal voltage for motor (V)	0 - 1000 [☆☆☆]	
P085	Nominal power for motor (kW/hp)	0 - 100.0 [☆☆☆]	
P086 ●	Motor current limit (%)	0 - 250 [150]	The motor current can be limited with this parameter. If the set value is exceeded, the output frequency is reduced until the current falls below this limit. During this process, both LEDs will flash *(see section 3.6)*.
P087	Motor PTC enable	0 - 1 [0]	Change this parameter only when the PTC option is fitted.
			0 = Disabled
			1 = Motor PTC enabled
			Note: If P087 = 1 and the PTC input goes high then the inverter will trip (fault code F004). Note that if the internal PTC gets too hot, the inverter will trip (fault code F005).
P089 ●	Stator resistance (Ω)	0.01- 100.00 [☆☆☆]	Set in the factory. *Do not adjust!*
P091 ●	Serial link slave address	0 - 30 [0]	Up to 31 CombiDrive® can be connected via the serial link and controlled by a computer or PLC using the USS protocol. This parameter sets a unique address for the inverter.
P092 ●	Serial link baud rate	3 - 7 [6]	Sets the baud rate of the RS485 serial interface (USS protocol):
			3 = 1200 baud
			4 = 2400 baud
			5 = 4800 baud
			6 = 9600 baud
			7 = 19200 baud
			Note: Some RS232 to RS485 converters are not capable of baud rates higher than 4800.

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Parameter	Function	Range [Default]	Description / Notes
P093 ●	Serial link timeout (seconds)	0 - 240 [0]	This is the maximum permissible period between two incoming data telegrams. This feature is used to turn off the inverter in the event of a communications failure. Timing starts after a valid data telegram has been received and if a further data telegram is not received within the specified time period, the inverter will trip and display fault code F008. Setting the value to zero switches off the control.
P094 ●	Serial link nominal system setpoint (Hz)	0 - 120.00 [50.00]	Setpoints are transmitted to the inverter via the serial link as percentages. The value entered in this parameter represents 100% (HSW = 4000H).
P095 ●	USS compatibility	0 - 2 [0]	**0** = Compatible with 0.1 Hz resolution **1** = Enable 0.01 Hz resolution **2** = HSW is not scaled but represents the actual frequency value to a resolution of 0.01 Hz (e.g. 5000 = 50 Hz).
P099 ●	Communication adapter type	0 - 1 [0]	**0** = Option module not present **1** = PROFIBUS module (enables parameters relating to PROFIBUS)

P101 ●	Operation for Europe or USA	0 - 1 [0]	This sets the inverter for European or USA supply and motor frequency:
			    0 = Europe (50 Hz)
			    1 = USA (60 Hz)
			Note: After setting P101 = 1 the CombiDrive® must be reset to factory defaults. i.e. P944 = 1 to automatically set P013 = 60 Hz, P022 = 60 Hz, P081 = 60 Hz, P082 = 1680 rpm and P085 will be displayed in hp.

P111	Inverter power rating (kW/hp)	0.0 - 10.00 [☆☆☆]	Read-only parameter that indicates the power rating of the inverter in kW. e.g. 0.55 = 550 W **Note:** If P101 = 1 then the rating is displayed in hp.
P112	Inverter type	1 - 8 [8]	Read-only parameter. **1** = MICROMASTER series 2 (MM2) **2** = CombiDrive® **3** = MIDIMASTER **4** = MICROMASTER Junior (MMJ) **5** = MICROMASTER series 3 (MM3) **6** = MICROMASTER Vector (MMV) **7** = MIDIMASTER Vector (MDV) **8** = CombiDrive® series 2
P113	COMBIMASTER model	24 - 29 [-]	Read-only parameter. **24** = CM150/3 **25** = CM220/3 **26** = CM300/3 **27** = CM400/3 **28** = CM550/3 **29** = CM750/3
P121	Enable/disable RUN button	0 - 1 [1]	**0** = RUN button disabled. **1** = RUN button enabled (only possible if P007 = 1).
P122	Enable/disable FORWARD/REVERSE button	0 - 1 [1]	**0** = FORWARD/REVERSE button disabled. **1** = FORWARD/REVERSE button enabled (only possible if P007 = 1).

Parameter	Function	Range [Default]	Description / Notes
P123	Enable/disable JOG button	0 - 1 [1]	**0** = JOG button disabled. **1** = JOG button enabled (only possible if P007 = 1).
P124	Enable/disable Δ and ∇ buttons	0 - 1 [1]	**0** = Δ and ∇ buttons disabled. **1** = Δ and ∇ buttons enabled (only possible if P007 = 1). **Note:** This applies for frequency adjustment only. The buttons can still be used to change parameter values.
P125	Reverse direction inhibit	0 - 1 [1]	**0** = Reverse direction disabled. Inhibits reverse commands from ALL sources (reverse RUN commands result in forward rotation) **1** = Normal operation (FORWARD/REVERSE operation allowed)
P131	Frequency setpoint (Hz)	0.00 -120.00 [-]	
P132	Motor current (A)	0.0 - 99.9 [-]	
P134	DC link voltage (V)	0 - 1000 [-]	Read-only parameters. These are copies of the values selected by P001 but can be accessed directly via the serial link.
P135	Motor RPM	0 - 40000 [-]	
P137	Output voltage (V)	0 - 1000 [-]	
P140	Most recent fault code	0 - 9999 [-]	The last recorded fault code *(see section 5)* is stored in this parameter. It is cleared when the inverter is reset. This is a copy of the code stored in P930.
P141	Most recent fault code -1	0 - 9999 [-]	This parameter stores the last recorded fault code prior to that stored in P140/P930.
P142	Most recent fault code -2	0 - 9999 [-]	This parameter stores the last recorded fault code prior to that stored in P141.
P143	Most recent fault code -3	0 - 9999 [-]	This parameter stores the last recorded fault code prior to that stored in P142.
P151 ●	Green LED function	0 - 5 [4]	**0** = Off **1** = On **2** = Fault mode: On = Tripped Flashing = Warning **3** = Running mode: On = Motor running Flashing = Inverter on but motor stationary **4** = Default mode *(see table in section 3.6)* **5** = *Not used*
P152 ●	Yellow LED function	0 - 5 [5]	**0** = Off **1** = On **2** = Fault mode: On = Tripped Flashing = Warning **3** = Running mode: On = Motor running Flashing = Inverter on but motor stationary **4** = *Not used* **5** = Default mode *(see table in section 3.6)*
P201	PI closed loop mode	0 - 2 [0]	**0** = Normal operation (closed loop control disabled). **1** = *Not used* **2** = Closed loop control using PI input for transducer feedback.
P202 ●	**P** gain (%)	0.0 - 999.9 [1.0]	Proportional gain.

Parameter	Function	Range [Default]	Description / Notes
P203 ●	**I** gain (%)	0.00 - 99.99 [0.00]	Integral gain. 0.01% corresponds to the longest integral response time.
P205 ●	Sample interval (x 25 ms)	1 - 2400 [1]	Sampling interval of feedback sensor.
P206 ●	Transducer filtering	0 - 255 [0]	**0** = Filter off. **1** - **255** = Low pass filtering applied to transducer.
P207 ●	Integral capture range (%)	0 - 100 [100]	Percentage error above which integral term is reset to zero.
P208	Transducer type	0 - 1 [0]	**0** = An increase in motor speed causes an increase in sensor voltage/current output. **1** = An increase in motor speed causes a decrease in sensor voltage/current output.
P210	Transducer reading (%)	0.0 - 100.0 [-]	Read only. Value is a percentage of full scale of the PI input.
P211 ●	0% setpoint	0.00- 100.00 [0.00]	Value of P210 to be maintained for 0% setpoint.
P212 ●	100% setpoint	0.00- 100.00 [100.00]	Value of P210 to be maintained for 100% setpoint.
P220 ●	PI frequency cut-off	0 - 1 [0]	**0** = Normal operation **1** = Switch off inverter at or below minimum frequency.
P331	Analogue mode	0 - 4 [2]	**0** = Internal potentiometer only **1** = External analogue input only **2** = Internal potentiometer + external analogue input **3** = Internal potentiometer fine, external input coarse **4** = Internal potentiometer coarse, external input fine
P332	Fine adjustment (%)	0 - 100 [10]	Percentage of fine tuning adjustment for P331 = 3 or 4.
P700			
P701 ●			*Specific to PROFIBUS-DP. See PROFIBUS Handbook for further details. (Access only possible with P099 = 1.)*
P702			
P723	State of digital inputs	0 - 7 [-]	**DIN3** **DIN2** **DIN1** **0** = 0 0 0 **1** = 0 0 1 **2** = 0 1 0 **3** = 0 1 1 **4** = 1 0 0 **5** = 1 0 1 **6** = 1 1 0 **7** = 1 1 1
P880			*Specific to PROFIBUS-DP. See PROFIBUS Handbook for further details. (Access only possible with P099 = 1.)*

Parameter	Function	Range [Default]	Description / Notes
P910 ●	Local/Remote mode	0 - 4 [0]	Sets the inverter for local control or remote control over the serial link: **0** = Local control **1** = Remote control (and setting of parameter values) **2** = Local control (but remote control of frequency) **3** = Remote control (but local control of frequency) **4** = Local control (but remote read and write access to parameters and facility to reset trips) **Note:** When operating the inverter via remote control (P910 = 1 or 3), the analogue input remains active when P006 = 1 and is added to the setpoint.
P918 ●			*Specific to PROFIBUS-DP. See PROFIBUS Handbook for further details. (Access only possible with P099 = 1.)*
P922	Software version	0.00 - 99.99 [-]	Contains the software version number and cannot be changed.
P923 ●	Equipment system number	0 - 255 [0]	You can use this parameter to allocate a unique reference number to the inverter. It has no operational effect.
P927 ● **P928** ●			*Specific to PROFIBUS-DP. See PROFIBUS Handbook for further details. (Access only possible with P099 = 1.)*
P930	Most recent fault code	0 - 9999 [-]	The last recorded fault code *(see section 5)* is stored in this parameter. It is cleared when the inverter is reset.
P931	Most recent warning type	0 - 9999 [-]	The last recorded warning is stored in this parameter until power is removed from the inverter: **002** = Current limit active **003** = Voltage limit active **005** = Inverter over temperature (internal PTC)
P944	Reset to factory default settings	0 - 1 [0]	Set to '1' and then press **P** to reset all parameters except P101 to the factory default settings.
P947 **P958** **P963** **P967** **P968** **P970**			*Specific to PROFIBUS-DP. See PROFIBUS Handbook for further details. (Cannot be accessed unless P099 = 1.)*
P971 ●	EEPROM storage control	0 - 1 [1]	**0** = Changes to parameter settings (including P971) are lost when power is removed. **1** = Changes to parameter settings are retained during periods when power is removed. **IMPORTANT** Take care not to exceed the EEPROM write cycle limit of 50,000/parameter (approx.) when using the serial link to update parameters, otherwise data loss or corruption may occur. Read cycles are unlimited.

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5. FAULT CODES

Fault codes are only available when an OPm2 is connected to the CombiDrive®.

In the event of a failure, the CombiDrive® switches off and a fault code appears on the LCD screen. The last fault that occurred is stored in parameter P930. e.g. '0003' indicates that the last error was F003.

Fault Code	Cause	Corrective Action
F001	Overvoltage	Check whether supply voltage is within the limits indicated on the rating plate. Increase the ramp down time (P003). Check whether the required braking power is within the specified limits.
F002	Overcurrent	Check motor lead and motor for short-circuits and earth faults. Increase the ramp-up time (P002). Reduce the boost set in P078 and P079. Check whether the motor is obstructed or overloaded.
F003	Overload	Check whether the motor is overloaded.
F004	Overheating of motor (monitoring with PTC)	Check if motor is overloaded. Check the connections to the PTC. Has P087 been set to 1 without a PTC being connected?
F005	Inverter overtemperature (internal PTC)	Check that the ambient temperature is not too high. The motor speed may be too low for a given load.
F006	Power module overtemperature	Check that the ambient temperature is not too high.
F008	USS protocol timeout	Check the serial interface. Check the settings of the bus master and P091 - P093. Check whether the timeout interval is too short (P093).
F009	Undervoltage	Check that the power supply is supplying enough voltage to the inverter.
F010	Initialisation fault / Parameter loss *	Check the entire parameter set. Set P009 to `0000' before power down.
F011	Internal interface fault *	Switch off power and switch on again.
F012	External trip	Source of trip is digital input (configured as an external trip input) going low - check the external source.
F013	Programme fault *	Switch off power and switch on again.
F018	Auto restart after fault	Automatic restart after fault (P018) is pending. **WARNING: The motor shaft may start to rotate at any time.**
F030	PROFIBUS link failure	Check the integrity of the link.
F031	Option module link failure	Check the integrity of the link.
F033	PROFIBUS configuration error	Check the PROFIBUS configuration.
F036	PROFIBUS module watchdog trip	Replace PROFIBUS module
F074	Motor overtemperature by I^2t calculation	Check that the motor current does not exceed the value set in P083.
F106	Parameter fault P006	Parameterise fixed frequency(ies) and/or motor potentiometer on the digital inputs.
F112	Parameter fault P012/P013	Set parameter P012 < P013.
F151 - F153	Digital input parameter fault	Check the settings of digital inputs P051 to P053.
F201	P006 = 1 while P201 = 2	Change parameter P006 and/or P201.
F212	Parameter fault P211/P212	Set parameter P211 < P212.

* Ensure that the wiring guidelines described in section 2.1 have been complied with.

When the fault has been corrected, restart the inverter and the motor will run if the fault has been cleared.

6. SPECIFICATIONS

CSA-single-phase device				
Model	**PM25/1**	**PM37/1**	**PM55/1**	**PM75/1**
Motor frame size: 4 pole	71K	71L	80K	80L
Motor output rating:	0.25 kW	0.37 kW	0.55 kW	0.75 kW
Operating input voltage:	1ø AC 208 - 240 V$_{rms}$ ± 10%			
Operating input frequency:	47 - 63 Hz			
Output frequency:	0 - 150 Hz			
Output frequency with. OPm2 or serial link: 4 pole	0 - 140 Hz	0 - 140 Hz	0 - 140 Hz	0 - 140 Hz
Input current:	3.2 A$_{rms}$	4.6 A$_{rms}$	6.2 A$_{rms}$	8.2 A$_{rms}$
Main fuse:	10 A			16 A
Min lead cross-section:	1 mm^2			1.5 mm^2

CSA-three-phase device					
Model	**PM37/3**	**PM55/3**	**PM75/3**	**PM110/3**	**PM150/3**
Motor frame size: 4 pole	71L	80K	80L	90S	90L
Motor output rating:	0.37 kW	0.55 kW	0.75 kW	1.1 kW	1.5 kW
Operating input voltage:	3ø AC 380 - 480 V$_{rms}$ ± 10% (all units) 3ø AC 460 - 500 V$_{rms}$ ± 10% (unfiltered only)				
Operating input frequency:	47 - 63 Hz				
Output frequency:	0 - 50 Hz				
Output frequency with. OPm2 or serial link: 4 pole	140 Hz	140 Hz	140 Hz	140 Hz	140 Hz
Input current:	2.2 A$_{rms}$	2.8 A$_{rms}$	3.7 A$_{rms}$	4.9 A$_{rms}$	5.9 A$_{rms}$
Main fuse:	10 A				
Min lead cross-section:	1 mm^2				

CSB-three-phase device					
Model	**PM220/3**	**PM300/3**	**PM400/3**	**PM550/3**	**PM750/3**
Motor frame size: 4 pole	100K	100L	112M	132S	132M
Motor output rating:	2.2 kW	3.0 kW	4.0 kW	5.5 kW	7.5 kW
Operating input voltage:	3ø AC 380 - 480 V$_{rms}$ ± 10% (all units) 3ø AC 460 - 500 V$_{rms}$ ± 10% (unfiltered only)				
Operating input frequency:	47 - 63 Hz				
Output frequency:	0 - 50 Hz				
Output frequency with. OPm2 or serial link: 4 pole	140 Hz	140 Hz	140 Hz	140 Hz	140 Hz
Input current:	4.7 A	6.4 A	10.0 A	12.2 A	16.0 A
Main fuse:	10 A	16 A		20 A	
Min lead cross-section:	1 mm^2	1.5 mm^2		2.5 mm^2	

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Input frequency:	47 Hz to 63 Hz
Power factor:	$\lambda \geq 0.7$
Output frequency range:	0 Hz to 50 Hz (0 Hz to 120 Hz using OPm2 or serial link)
Resolution:	0.01 Hz
Overload capability:	150% for 60 s, related to nominal current
Protection against:	Inverter overtemperature Motor overtemperature Overvoltage and undervoltage
Additional protection:	Against short-circuits and locked motor shaft
Analogue Input:	0 - 10 V/2 - 10 V (recommended potentiometer 4.7 kΩ) 0 - 20 mA/4 - 20 mA
PI Input:	0 - 10 V 0 - 20 mA
Analogue setpoint resolution:	10-bit
Setpoint stability:	Analogue < 1% Digital < 0.02%
Motor temperature monitoring:	I^2t control PTC input
Ramp times:	0 - 650 s
Control outputs:	1 relay 24 V DC / 1 A **WARNING:** External inductive loads must be suppressed in an appropriate manner *(see section 2.1 (4))*.
Interface:	RS485
Inverter efficiency:	97%
Operating temperature:	-10°C to +40°C
Storage/transport temperature:	-40°C to +70°C
Humidity:	99% non-condensing
Installation height above sea level:	< 1000 m
Degree of protection:	IP55 IP65 (inverter housing)
Protective separation of circuits:	Double insulation or protective screening
Electro-magnetic compatibility (EMC):	*See section 7.3*

Options / Accessories

Clear Text Display (OPm2)	6SE3290-0XX87-8BF0
Interface cable for OPm2 (length = 1 m)	6SE9090-0XX87-8SK0
Interface cable for OPm2 (length = 3 m, shielded + gland)	6SE9996-0XA30
PROFIBUS Module (CB155)	6SE9996-0XA20
Pulse Resistor Braking Unit (incl. E-M brake control) *	6SE9996-0XA11
Electro-mechanical Brake Control Unit *	6SE9996-0XA10
SIMOVIS PC Software	6SE3290-0XX87-8SA0

* Case size B

Pulse Resistor Braking Unit Option

The pulse resistor braking unit provides the CombiDrive® with up to 3 kW (peak) of braking power for stopping the system more quickly than would otherwise be possible. It has all the functionality of the electro mechanical brake control unit *(see below)* and also provides increased immunity to overvoltage trips.

The braking unit replaces the standard cover for the inverter unit and requires no wiring. It houses the braking control electronics and a 3 kW braking resistor with heatsink. Full IP65 environmental protection is maintained.

Electro-mechanical Brake Control Unit Option

The electro-mechanical brake control unit allows the CombiDrive® to control an electro-mechanical brake directly. The unit provides an output to drive the coil of a 180 V DC electro-mechanical brake. It can be configured for both fast and slow operation of the coil. The unit is configured using parameters P062, P063 and P064. These provide full control of the brake release time and brake stopping time.

The brake control unit replaces the standard cover for the inverter unit. Full IP65 environmental protection is maintained.

PROFIBUS Module Option

This option allows the CombiDrive® to be controlled via a PROFIBUS-DP serial bus (SINEC L2-DP). The PROFIBUS module fits to the side of the CombiDrive® using two screws.

Features:

- Permits fast cyclic communications via a PROFIBUS connection.
- Supports all PROFIBUS baud rates up to 12 MBaud.
- Control of up to 125 inverters using PROFIBUS-DP protocol (with repeaters).
- Conforms to the relevant parts of DIN 19245 and EN50170, guaranteeing open communications on a serial bus system. It can be used with other PROFIBUS-DP/SINEC L2-DP peripheral devices on the serial bus. Data format conforms to the VDI/VDE directive 3689 'PROFIBUS Profile for Variable Speed Drives'.
- Can be configured easily using Siemens COM ET 200, COM ET Windows or S7 Manager software.
- Simple integration into a SIMATIC S5 or S7 PLC system using specially designed functional blocks (S5) and software modules (S7).
- Simple connection to the CombiDrive® (same as Clear Text Display module).
- No separate power supply required.
- Digital and analogue inputs can be read and digital and analogue outputs controlled via the serial bus.
- Approx. 5 ms response time to process data
- Motor speed can be controlled locally on the drive or via the serial bus.
- Multi-mode operation is possible - control data can be input via the terminal block (digital inputs) and the setpoint transmitted via the serial bus. Alternatively, the setpoint can be set locally (analogue input) with the control data transmitted via the serial bus.
- All drive parameters are accessible over the serial link.

7. SUPPLEMENTARY INFORMATION

7.1 Application Example

Setup procedure for a simple application

Application requirements: Normal operating frequency set within range 15 - 50 Hz via potentiometer. Counter-clockwise rotation required.

CombiDrive® used: Any model.

Procedure:
(1) Remove the link (if fitted) between control terminals 5 and 8.

(2) Connect a simple on/off switch to control terminals 6 and 8 for reverse rotation.

(3) Connect a 4.7 kΩ potentiometer to the control terminals *(see Figure 4)*.

(4) Set jumper JP301 ('V' - voltage) - *see Figure 3.*

(5) Set the internal and external potentiometers fully counter-clockwise and then apply mains power and switch on.

(6) Turn the internal potentiometer clockwise until the motor rotates at a speed that approximates to 15 Hz.

(7) The external potentiometer now has a range of between 15 Hz at its lowest setting and 50 Hz at its highest setting.

7.2 USS Status Codes

The following list gives the meaning of status codes displayed on the OPm2 when the serial link is in use and parameter P001 is set to 006:

001 Message OK
002 Slave address received
100 Invalid start character
101 Timeout
102 Checksum error
103 Incorrect message length
104 Parity fail

Notes

(1) The display flashes whenever a byte is received, thus giving a basic indication that a serial link connection is established.

(2) If '**100**' flashes on the display continuously, this usually indicates a bus termination fault.

7.3 Electro-Magnetic Compatibility (EMC)

Class 2: Filtered Industrial (Class A)

This level of performance will allow the manufacturer/assembler to self-certify their apparatus for compliance with the EMC directive for the industrial environment as regards the EMC performance characteristics of the power drive system. Performance limits are as specified in the Generic Industrial Emissions and Immunity standards EN 50081-2 and EN 50082-2.

EMC Phenomenon	Standard	Level
Emissions:		
Radiated Emissions	EN 55011	Level A1
Conducted Emissions	EN 55011	Level A1
Immunity:		
Supply Voltage Distortion	IEC 1000-2-4 (1993)	
Voltage Fluctuations, Dips, Unbalance, Frequency Variations	IEC 1000-2-1	
Magnetic Fields	EN 61000-4-8	50 Hz, 30 A/m
Electrostatic Discharge	EN 61000-4-2	8 kV air discharge
Burst Interference	EN 61000-4-4	2 kV power cables, 2 kV control
Radio Frequency Electromagnetic Field, amplitude modulated	ENV 50 140	27-1000 MHz, 10 V/m, 80% AM, power and signal lines

Class 3: Filtered - for residential, commercial and light industry (Class B)

This level of performance will allow the manufacturer / assembler to self-certify compliance of their apparatus with the EMC directive for the residential, commercial and light industrial environment as regards the EMC performance characteristics of the power drive system. Performance limits are as specified in the generic emission and immunity standards EN 50081-1 and EN 50082-1.

EMC Phenomenon	Standard	Level
Emissions:		
Radiated Emissions	EN 55022	Level B1
Conducted Emissions	EN 55022	Level B1
Immunity:		
Electrostatic Discharge	EN 61000-4-2	8 kV air discharge
Burst Interference	EN 61000-4-4	1 kV power cables, 0.5 kV control

Note: The CombiDrive® is intended **exclusively for professional applications**. Therefore, it does not fall within the scope of the harmonics emissions specification EN 61000-3-2.

7.4 Environmental Aspects

Transport and Storage

Protect the CombiDrive® against physical shocks and vibration during transport and storage. The unit must also be protected against water (rainfall) and excessive temperatures *(see section 6).*

The packaging is re-usable. Retain the packaging or return it to the manufacturer for future use.

Dismantling and Disposal

The component parts can be recycled, disposed of in accordance with local requirements or returned to the manufacturer.

Documentation

This handbook is printed on chlorine-free paper which has been produced from managed sustainable forests. No solvents have been used in the printing or binding process.

7.5 User's Parameter Settings

Record your own parameter settings in the table below:

| Parameter	Your setting	Default	Parameter	Your setting	Default	Parameter	Your setting	Default
P000		-	P058		0.0	P141		-
P001		0	P061		6	P142		-
P002		10.0	P062		0	P143		-
P003		25.0	P063		1.0	P151		4
P004		0.0	P064		1.0	P152		5
P005		50.00	P065		1.0	P201		0
P006		1	P071		0	P202		1.0
P007		0	P072		250	P203		0.00
P009		0	P073		0	P205		1
P011		0	P074		1	P206		0
P012		0.00	P077		0	P207		100
P013		50.00	P078		100	P208		0
P014		0.00	P079		0	P210		-
P015		0	P081		☆☆☆	P211		0.00
P016		0	P082		☆☆☆	P212		100.00
P017		1	P083		☆☆☆	P220		0
P018		0	P084		☆☆☆	P331		2
P019		2.00	P085		☆☆☆	P332		10
P020		5.00	P086		150	P700 *		-
P021		0.00	P087		0	P701 *		0
P022		50.00	P089		☆☆☆	P702 *		-
P023		2	P091		0	P723		-
P024		0	P092		6	P880 *		-
P027		0.00	P093		0	P910		0
P028		0.00	P094		50.00	P918 *		-
P029		0.00	P095		0	P922		-
P031		5.00	P099		0	P923		0
P032		5.00	P101		0	P927 *		0
P035		0	P111		☆☆☆	P928 *		0
P041		5.00	P112		8	P930		-
P042		10.00	P113		-	P931		-
P043		15.00	P121		1	P944		0
P044		20.00	P122		1	P947 *		-
P045		0	P123		1	P958 *		-
P046		25.00	P124		1	P963 *		-
P047		30.00	P125		1	P967 *		-
P048		35.00	P131		-	P968 *		-
P050		0	P132		-	P970 *		1
P051		1	P134		-	P971		1
P052		2	P135		-			
P053		10	P137		-			
P056		0	P140		-			

* Parameters specific to PROFIBUS-DP.

☆☆☆ = Value depends on the rating of the inverter.

8.1 Control box (Steuerbox) for CombiDrive® integrated / connection diagram

Function	Farben	Number	Designation
Dir. of rotation / r.p.m,	green	1	P10+
Dir. of rotation / r.p.m,	grey	1	P10+
Dir. of rotation	pink	5	DIN1
Dir. of rotation	yellow	6	DIN2
r.p.m	white	3	AIN+
r.p.m.	brown	4	AIN
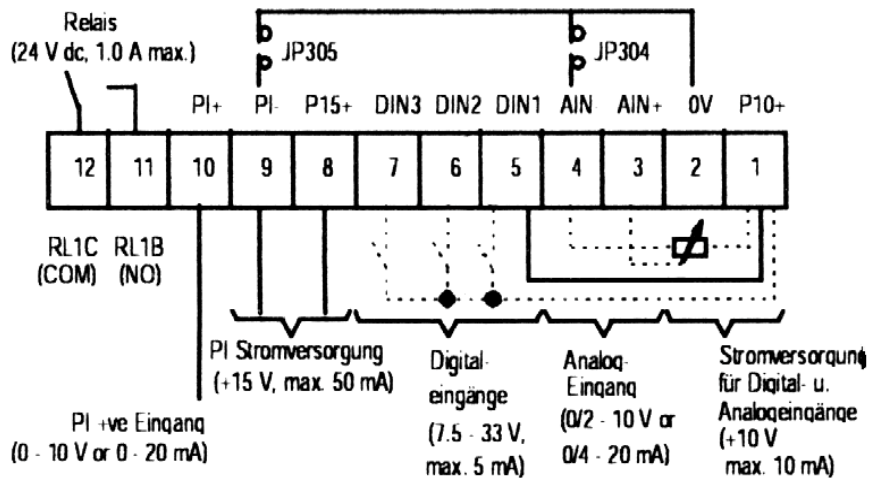
PL800 (CSB) / PL700 (CSA)

Caution

JP304 jump OV and AIN.

Terminal 1 and 5 must be jumped.

Notes

It is essential to read and combly with these instructions prior to installation and commissioning.

Notes:
Since the terminals are equipped with wire protection, multi-core wire should be twisted to fit the terminals. An additional conector sleeve is not required.
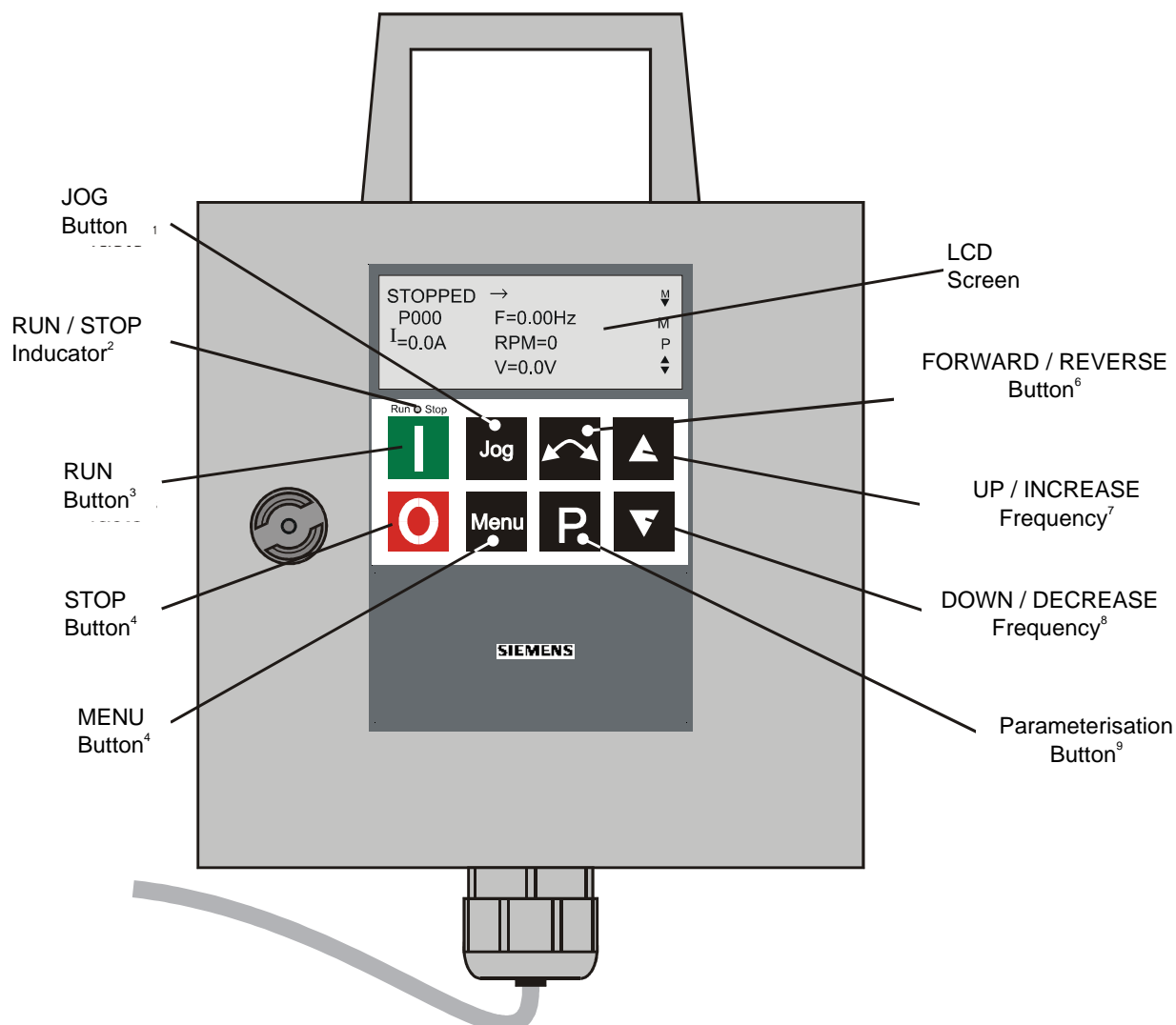
02.07.03

8.2 Clear text Display Module (Opm2) in IP55 housing

see chap. 4.1.

This section only applies for users who intend using the optional Clear Text Display module (OPm2) to control the operation of the CombiDrive®.

The OPm2 module provides a multi-language user-friendly interface to the *CombiDrive®*. The display is menu-driven and provides information in simple text form. It also includes built-in context-sensitive Help screens.

As well as enabling direct control of the motor, the OPm2 extends the functionality of the *CombiDrive®* by providing access to a comprehensive range of adjustable parameters. Setting these parameters will allow you to customise the operation of the *CombiDrive®* to meet almost any application requirement.

JOG Button [1]

RUN / STOP Inducator [2]

RUN Button [3]

STOP Button [4]

MENU Button [4]

LCD Screen

STOPPED →
P000 F=0.00Hz
I=0.0A RPM=0
V=0.0V

FORWARD / REVERSE Button [6]

UP / INCREASE Frequency [7]

DOWN / DECREASE Frequency [8]

Parameterisation Button [9]

[1] *Pressing this button while the motor is stopped causes it to start and run at the preset jog frequency. The motor stops as soon as the button is released. Pressing this button while the motor is running has no effect. Disabled if P007 or 123 = 0.*

[2] **Green** *indicates that the motor is running.*
Flashing **green** *indicates that the motor is ramping up or down.*
Red *indicates that the motor is stationary.*
Flashing **red** *indicates a fault condition.*

[3] *Press to start the inverter. Disabled if P007 or P121 = 0.*

[4] *Press to stop the inverter.*

[5] *Changes the display to show the menu options. Pressing and holding this button down and then pressing the ∇ button causes the Help screen to be displayed.*

[6] *Press to change the direction of rotation of the motor. REVERSE is indicated by a minus sign (values <100) or a flashing decimal point (values > 100). Disabled if P007 or P122 = 0.*

[7] *Press to INCREASE frequency. Used to change parameter numbers or values to higher settings during the parameterisation procedure. Disabled if P124 = 0.*

[9] *Press to access parameters. Disabled if P051 - P053 = 14 when using digital inputs.*

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